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"Process for making a versatile clamping device designed for holding objects without damage, such a device and its use.

(Substitute Specification)

IN THE NAME OF

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Serial Number No. 07/938,211

PROCESS FOR MAKING A VERSATILE CLAMPING DEVICE DESIGNED FOR HOLDING OBJECTS WITHOUT DAMAGE, SUCH A DEVICE AND ITS USE

1. FIELD OF THE INVENTION

The present invention relates to a method of making a multipurpose clamping device designed for holding objects without damaging them, such a device and its use.

2. PRIOR ART

Among the clamping tools including two jaws, of which one can slide along a straight guide piece, some of them are totally lacking forceable pressing means, such as screws, eccentrics, springs, hydraulic means or the like. Thus Ralph K. Coffman has filed in 1945 a patent application to get the US patent No. 2,510,077 which discloses such a tool. Coffman's tool is characterized in that said guide piece comprises several (three on the drawings) parallel and distinct cylindrical rods distributed along the jaws depth, and said jaws are equipped at one of their ends with cork pads facing each other. On the other hand, the rods are laterally linked to each other by small bars at each of their ends, the central rod being tied to these small bars. Therefore said jaws are kept imprisoned between these said small end bars. It seems that Coffman was utterly convinced that could the jaws lock by friction on the guide piece, should this guide include several rods and these rods be automatically bent for clamping. Consequently could the jaws be parallel to each other for clamping, should these ones be leaning towards each other at rest, on the cork pads side, by an acute angle.

No more he seemed to be familiar with the moulding clamp, called "presse-marteau" or "hammer-press", such it has been disclosed page 107, figure 257, in Lombard & Masviel' book, entitled "Cours de Technologie", Band 1 (wood) and published by Dunod & Pinat in 1907 in Paris. This "hammer-press" which belongs to the kind of clamping tools mentioned at the beginning of this prior art review also lock by friction, but its guide piece comprises only one rod and its jaws are essentially parallel to each other at rest. This "hammer-press" is also found, always offered made of wood (generally of hornbeam wood), in many commercial hardware catalogues, such as the 1910 one of "Charbonnel et Fils" in Thiviers, Dordogne, France, on figure 378 of 40th plate, such as the 1924 one of "Etablissements F. Guitel and Etienne réunis" in Saint Martin street in Paris, on figure 2592 of page 232, and such as the 1927 one of the "Forge Royale" in Faubourg Saint Martin street in Paris, figure 306 of 32th plate. Besides the fact that the guide piece comprises only one cylindrical rod, one of the jaws is systematically fixed at one end of said rod and every one of said jaws is lacking any pad, made of cork or something else, but is equipped at the farthest end from the rod in front of the other jaw with a place, where a pad could be precisely sticked on. Moreover, in 1948, the same "hammer-press", with a jaw fixed at one end of the rod and a parallel jaw running on said rod, is presented on pages 27 and 28, in sight of figure 42, with cork pads at this place, by Trillat, cabinetmaking teacher, in his book entitled "Le Guide Pratique du Métier" ("The Practical Guide for Skill"), published by Fillet & Combe in Bourgouin (Isère, France). Henri Trillat has become familiar with the "hammer-press" equipped with cork pads, before becoming teacher of technical education in 1932, as he was an employee in cabinetmaking

workshops (as a foreman for furniture manufacturing, at the end). Therefore, he has taught this clamp to his students from 1932. Numerous "hammer-presses" with cork pads can be found in old cabinetmaking workshops in France. A distinctive feature of the "hammer-press", such as it is represented in Trillat's book, is that the straight rod supporting the jaws is circular, whereas in the aforementioned commercial catalogues, the rod is systematically shown with a rectangular section. And this "hammer-press" is hand clamped, as Trillat states it page 83, this time in sight of figure 31 of a revision of his first work, entitled "Technologie Générale et de Spécialité en Menuiserie-Ebénisterie" ("General and Special Technology for Joinery and Cabinetwork) and published by Dunod, Paris, in 1959. This "hammer-press" can be quite compared to the clamps that have been disclosed later on in the patent applications filed by Ditto in May 1981 (to get the US patent No. 4,555,100) and filed by Pappas in November 1984 (PCT/US85/00420 application) except that the guide piece in Ditto and in Pappas appears to be parted in two parallel straight rods. Pappas considers however, at the two thirds of the page 3, that the guide piece of the jaws might be made up of only one rod. Both are claiming a clamping tool comprising two jaws and a straight guide piece. One of said jaws is fixed to one end of said guide piece. The other jaw can run along said guide piece parallel to said first jaw and remaining parallel thereto at rest. Each of said two jaws is provided at a distance from said guide piece, as it is for Trillat's "hammer-press", with an elastic cork-type pad facing the other jaw.

3. and 4. SUMMARY AND ADVANTAGES OF THE INVENTION

The present invention is distinct from the prior art evoked before in what it consists first in making movable and easy to be slipped outwards and inwards of the guide piece, the so far fixed jaw of Trillat's "hammer-press". Therefore, not only both jaws are movable, but they are easy to be slipped outwards of the guide piece, unlike the variant shown on figure 2 of Coffman, where both jaws are movable along the rod but remain captive on said rod because of the small bars at the rod ends.

Thus, a clamping device equipped according to the present invention comprises the combination of:

- a cylindrical support part, such as a rod or a tube, with a section circular or not,
- at least two movable and removable arms which can slide along said support part and be turned around it into at least one direction and which can be easily slipped outwards thereof and inwards again,
- at least one buffer secured to one of the arms at a single distance from said support part and having a contact face which is essentially at a right angle to said support part and under which the layer is elastic enough to act as a compression spring.

That gives the "hammer-press" new and considerable possibilities and turns said press into a versatile tool. Indeed not only the new "hammer-press" according to the present invention can be used as a clamp, but also, when the jaws are reversed on the support part, as a holder apart to press against the recess sides, and by adding jaws on same support part, as an overlapping clamp, which is a new kind of clamp with four jaws providing a spectacularly sturdy and stable clamping, and various types of ample

multiple helping hands. By joining two support parts end to end with a coupler of the electrical connector type and by positioning at least one of the jaws on each of said two support parts, the maximum opening is considerably extended.

Such connectors, when they are multiple, make possible a parallel coupling of the rods to build multicontact vices or to perform multidirectional clamping, possibly one after another, by bending electrical connector bars (of which the coating is usually make out of a supple plastic material) and securing them short to some of said support parts.

Therefore a device according to the invention can be obtained by the global method comprising the following steps of:

a) providing a cylindrical support part, such as a rod or a tube, with a section circular or not,

b) placing on said support part at least two movable and removable arms which can slide along said support part and be turned around it into at least one direction and which can be easily slipped outwards thereof and inwards again,

c) fitting at least one of the movable arms out at a single distance from said support part with one buffer having a contact face which is essentially at a right angle to said support part and under which the layer is elastic enough to act as a compression spring.

The present invention can further be distinguished from the prior art evoked before through the replacement of the traditional cork pads by ring buffers elastic on all sides, but with a greater thickness under the contact face. There are numerous advantages of ring buffers over cork pads. First of all, there is no more need for a fastening system, such as a sticking, such as a pin and a hole, to secure the pad or buffer to the jaw. Additionally, the ring buffers can receive and support laterally other buffers fitting out others jaws, thereby enabling and facilitating all angular directions of clamping, whatever is the outline shape of the parts to be clamped. And of course, the ring buffers are easily interchangeable with differently contoured ring buffers, to seize for example pieces difficult of access. Thornton (US patent No. 4,834,352) thought for his handle-equipped clamping device of totally surrounding the jaw ends with safety sheaths however under an uniform layer. The purpose of these sheaths was to act as protecting wedges, but not as an essential means for exerting a pressure during clamping . The pressure means is materialized in Thornton by a big pin-shaped spring. In the present invention, the ring buffers are constituting the pressure means for the clamping and consistently they are thicker in the clamping direction. That is in what the ring buffers are differing from the safety sheaths of Thornton. The difference is all the more marked since Thornton's device is clearly departing from the "hammer-press" concept. It is more like a clothes peg extrapolation towards a large opening with the traditional defects of the clothes peg: jaws diverging from parallel during the clamping operation and force nearly impossible to be controlled because of the lever effect. The use of safety sheaths which is otherwise classic (around pliers noses or around fingers with gloves) is not liable to fundamentally alter the performances of the clothes peg. On the contrary, the use of ring buffers, as pads, for the "hammer-press", gives thereto new properties, such as the possibility in conjunction with

another "hammer-press" according to the present invention, of clamping in all angular directions with an automatic control of the clamping force, which would be rather difficult if not impossible with Thornton's press.
So that said at least two movable and removable arms could be easily slipped outwards of said support part and inwards again, the support part ends might be equipped with removable stops of the type clips, riders, pins, keys, or sections of cylindrical supple sheath slipped on by a gentle forcing.
A device according to the present invention will be called an assembler for the rest of the description.
The clamping operation of an assembler, comprising only two arms, consists of pushing the last ones towards each other, the buffer of one of said arms having its contact face facing the contact face of the buffer of the other arm. The pushing force is translated more or less between the arms in front of the buffer(s). As soon as the resistance against the pushing is felt at the expected level, the pushing is stopped. Then the arms lock on by tipping against said support part as the suspended poles of the ski tow do against their cable, whether something would be held between the arms in front of the buffer(s) or not. The holding apart is performed according to the same principle: the arms being reversed along the support part, pushing is made in the opposite direction.
The clamping operation is the same when the support part is splitted up into several cylindrical parallel components, distributed not along the arms unlike in Coffman, Ditto or Pappas, but at a right angle to said arms.
With an assembler just comprising four movable arms which can be turned in two directions V-diverging about said support part, said arms being fitted out with buffers, the buffers of the first two arms along said support part having their contact faces facing the contact faces of the buffers of the two following arms, the clamping operation is different in the approach of the movable arms, but the locking remains the same. The two first arms are V-diverging around said support part and are being pushed towards the following ones, more or less positioned according to same V. Roughly the first arm buffer is facing the third arm buffer while the second arm buffer is facing the fourth arm one. As soon as the buffer contact faces are touching the surfaces of the pieces to be clamped and as a sufficient resistance is felt, pushing is stopped. Such a clamping operation has been called "overlapping" and such an assembly of four movable arms on a cylindrical support part has been called "overlapper" or "super-assembler".
The overlapping can be used as well for holding apart. The operation is the same except that arms are reversed along the support part. A configuration halfway between a single assembler and an overlapper or super-assembler according to the present invention can be obtained by using two movable arms V-diverging facing a single third one for the clamping. Depending on the relief of the surfaces to be held, such a configuration might be sufficient.
With the overlapping which offers four contact faces, one can notice a spectacularly more vigourous and stable clamping than with an assembler comprising only two movable arms, even upon tortured patterns. When an overlapper is clamping a small wood plaque upon a table edge with about 60° as an angle for the V formed either by the first arms or by the following

ones, it is extremely difficult to detach said wood plaque from the table, whereas each movable arm only underwent the thrust of one finger extremity during the clamping operation. To perform such a detaching, one hand grabing the small wood plaque with all fingers and drawn itself by a human arm of medium strength is insufficient. On the other hand, it appears that it is quite possible to carry out a stable and efficient clamping even if the four buffers are pressing by their contact face at different levels upon a tortured relief. Such a possibility is of course extremely practical for the restoration of gilded artifacts such as frames and cartouches. With the sub-variant of the overlapper comprising only three arms, two first ones forming a V and a third one pressing more or less in front of the middle of the V, one can avoid obstacles which prevent from clamping oppositely. Thus for clamping a foot against the clock pedestal, this foot being opposite a column which stands above the pedestal, the buffers of said movable parts forming the V are taking hold on both sides of said column while the buffer of the opposite movable arm is pressing upon said foot.

If a third pair of movable arms fitted out with such buffers is added onto a bare portion of the support part of an overlapper grasping the lateral edge of an horizontal bench or table and if said third pair is holding some objects to be painted or to be worked on with free hands, one gets a helping hand. This helping hand is called a third vertical helping hand. If to this third pair of movable arms, called an holder, is added a fourth, a fifth, etc... pair of movable arms, still placed on a bare portion of the support part, one gets successively one fourth, one fifth vertical helping hand. When each of the added pairs of movable parts, also called holders, can be turned in several directions around said support part, these auxiliary hands are even better practical.

Øne can get another configuration of auxiliary hands by placing along said support part, one behind the other, three pairs of movable arms fitted out with substantially elastic buffers, said buffers facing each other by their respective contact face for each pair. At one end of the support part, the two first pairs of movable arms are separately locked by clamping with each buffer having its contact face against the contact face of the other buffer at an angle not equal to zero but possibly markedly upper or lower than 90°. Along the remaining portion of the support part, the third pair of movable arms also constitutes a holder to hold objects to be painted or to be worked on with free hands. The so built helping hand is called for the remainder of the present specification a third horizontal helping hand: it can be installed anywhere on a more or less horizontal surface because it rests on three feet: the sets of the buffers of the first two pairs of movable arms locked at one end of the support part and the other end of the last one. If to this third pair is added a fourth, a fifth, etc... pair of movable arms, still placed on the remaining portion of the support part, one gets successively one fourth, one fifth horizontal helping hand.

Nota bene: So that one of the above-mentioned helping hands could keep objects in position firmer, one holder can be replaced by one overlapper.

The interest of the just above decribed helping hands as compared with the traditional helping hands lies in different aspects:

- Firstly, the holders that are equipping the helping hands according to

the invention cannot with their elastic buffers scratch held pieces as the crocodile clips of the traditional helping hands can do with their teeth.
- Secondly, unlike crocodile clips these holders are provided with jaw members which can open very widely while remaining parallel to each other.
- Lastly, the helping hands according to the invention are distinctly lighter than the traditional helping hands since they do not require a heavy pedestal to keep standing, even when the holders are loaded. Four of the movable arms which are placed along the support part are sufficient to steady the basis of such kinds of helping hands (see above). That just shows the generic power of the combination: cylindrical support part, movable arms and substantially elastic buffers.

Of course, configurations as the overlapper and the vertical and horizontal helping hands can only be built because of the possibility for the movable arms to be turned in more than one direction around the support part.

15 The modularity of the assemblers, which derives from the movability of the arms along the cylindrical support part, is creating a faculty not available up to now with the clamping tools: increasing at will the maximum opening. Said arms can be slipped outwards of their support part (the possible stops at ends thereof are removable) and slipped onto another support part of same section. Cylindrical support parts can be fixed end to end by couplers such as electrical connecting devices, muffs for mechanical pipes or cable links. It matters little that the couplers are barriers against the mobility of the arms between the different support parts. Placing one movable part on each of the two most extreme ortions of said support parts is sufficient and the maximum opening between the two so used movable arms is inevitably larger than it would be if these two arms would be placed on only one of these support parts. In this manner the maximum opening according to the invention easily becomes extensible, which contrasts sharply with the traditional clamps where the binding of one of the jaws to one of the end of the support part makes inconceivable the extension thereof. Naturally, if not one but several movable parts are placed on each of the two most extreme portions of the support parts so connected end to end, it is possible to give a considerable maximum opening to all above disclosed original variants of the invention, as the overlapper and the new kinds of helping hands, etc... On the other hand, it can be also contemplated extending a support part with support parts having a different section by couplers the inlets of which being fit for different diameters (this is the case of connecting devices for big section electrical wires) so that movable arms having different dimensions could be faced to each other. Depending upon the shape of the objects to be clamped, such an arrangement can be very helpful.

According to a somewhat similar arrangement, denominated "radial clamping", on the support part of an assembler including a minimum of two movable arms is secured a coupler fit to seize, in at least one direction distinct from said support part direction another support part which can carry a minimum of one movable arm provided with an elastic buffer. Such a coupler is possibly made of a crosspiece like those which are used in electricity as a shunt contact or those which are used in the Navy or in "Mecano" building set to secure the crossing of two cables or halyards. It might also consist of a little bar of electrical connecting devices which is kept bent for

example by the way it is secured to the first of said support parts. If this support part and another of said ones are at an angle of about 90°, it is possible to clamp things by three sides (T clamping) or by four sides (cross clamping). And when the coupler can hold several support parts in directions all distinct from the direction of the support part upon which the coupler is secured, it is possible to clamp things by numerous sides between the movable arms which are carried by said support parts. Such a clamping is then called a radial clamping. Of course said clampings, the T one, the cross one and the radial one, can be operated with movable parts combined in overlappers. With the radial clamping, it is of pulling towards each other the corner sides of a frame and of gripping round objects markedly more firmly.

Another faculty brought by the invention also results from the movability of the arms along the cylindrical support part. One of the movable arms of a holder apart according to the invention, i.e. an assembleur of which the movable parts have been reversed along its support part, said assembler comprising just two movable arms, each of them being fitted out with an elastic buffer, can be slipped at one of the furthest ends of the support part (the possible stops are removable). If an auxiliary bar, such as a ruler or a tool handle is kept fastened parallel to a large surface (for example, by the holders of two third vertical helping hands according to the invention, the overlapper of one of said two vertical helping hands gripping an edge of said large surface which is opposite the edge of same surface gripped by the overlapper of the other vertical helping hand), it is possible with the buffer of this movable arm to press at any place of this surface along this bar. There is no risk for the support part of damaging said surface since it does not go beyond said movable arm. The assembler working as an holder apart, it is sufficient that its other movable arm buffer takes support against the auxiliary bar. By reason of this kind of clamping which has been called "covering clamping", the jaw depth or projection is made unlimited. The assembler can exert a pressure whatever is the distance from the edge of a large surface, possibly plane, convex, concave or tortured. It is sufficient that the auxiliary bar more or less follows the outlines of the surface, be long enough and positioned in the good direction. For a stronger pressure, the assembler which has to be turned into a holder apart might be replaced by an overlapper. Until now this type of clamping by covering was not much familiar to persons having ordinary skill in the art, because traditional clamps could not generally be turned into holders apart and a holder apart was a special tool rarely available in the workshops. In addition wedges are rather difficult to be used with a traditional holder apart. According to the present invention, the covering clamping can be easily and directly executed with the very same assemblers as the ones which permit of making all the other above disclosed original arrangements, provided if needed with additional movable arms. It is the multipurpose characteristic of the new assembler.

Another worthwhile feature of the invention, when every movable arm is fitted out with a ring buffer, is that a ring buffer belonging to a clamping or holding apart assembler can support against its side, under various angles, the pressure of a buffer belonging to a second assembler in clamping or holding apart position. This feature results from that every

elastic substance which can go into such a buffer is malleable and generally not slippery. Therefore the buffer of another movable arm of said second assembler can force against the side of an object even this last one has not another side parallel to said first side or against a buffer belonging to a third assembler, also in clamping or holding apart position. Such a positioning permits of clamping even there is no outline easy to be seized, which is often the case of objets d'art to be restored. This positioning was so far very difficult to be achieved with traditional clamps because sizeable and crooked wedges had to be jammed under the jaws, said wedges being always uneasy to be put in and sometimes hard to be found out. Generally such a positioning was requiring more than two hands and was brutishly forcing whatever was the solidity of the objects to be clamped. This positioning turns to be elementary, even under a weak clamping force, with the new assembler, owing to the use of elastic ring buffers. It has been called angle clamping, staple clamping or bridge clamping, according to the number of assemblers which are involved. For a firmer anchorage, the supporting assembler possibly can be replaced by an overlapper.

The result of all the foregoing is that the assembler according to the invention is multipurpose and that its general process of use, which permits of holding objects by clamping without damaging them, comprises the following steps:

a) applying the buffer secured to each of said arms against one of said objects or against one of the sides of a buffer secured to another arm or against some auxiliary rigid element,

b) exerting on the back of each of said arms along the support part which carries said arm, a manual thrust,

c) stopping this thrust, so as to lock each of said arms by tilting against the support part which carries said arm.

Other characteristics and advantages of the invention will be more apparent from the following detailed description in view of the attached drawings, upon which:

6. BRIEF DESCRIPTION OF THE DRAWINGS

- FIG. 1 is a sectional elevation of an assembler according to the invention comprising two movable arms wherein only one arm is provided with an elastic slice-shaped buffer.

- FIG. 2 is a sectional elevation of an assembler according to the invention comprising two arms, wherein each of said arms is provided with an elastic slice-shaped buffer.

- FIG. 3 is a sectional elevation of an assembler according to the invention comprising two arms, wherein each of said arms is provided with an elastic ring buffer.

- FIG. 4 is a sectional elevation showing how the assembler of FIG. 2 can be used for pressing an assembly of two objects.

- FIG. 5 is a perspective of an assembler according to the invention comprising four movable arms arranged as an overlapper wherein each one of said arms is provided with an elastic ring buffer.

- FIG. 6 is a perspective of an assembler according to the invention comprising six movable arms arranged as a vertical third helping hand, each arm being provided with an elastic ring buffer.

- FIG. 7 is a perspective of an assembler according to the

invention comprising eight movable arms arranged as a horizontal fourth helping hand, each arm being provided with an elastic ring buffer.

- FIG. 8 is a perspective of an assembler according to the invention wherein the support part has secured thereto a coupler which supports another support part in a direction perpendicular to that of the first said support part, said another support part carrying two other movable arms each provided with an elastic ring buffer.

6. BEST MODE FOR CARRYING OUT THE INVENTION

Referring now to Fig. 1 to 8, a multipurpose clamp according to the present invention hence comprises in combination:

- a cylindrical support part 1, such as a rod or a tube, with a section circular or not,
- at least two movable and removable arms 2 which can slide along said support part 1 and be turned around it into at least one direction and which can be easily slipped outwards thereof and inwards again,
- at least one buffer 3 secured to one of the arms 2 at a single distance from said support part 1 and having a contact face which is essentially at a right angle to said support part and under which the layer is elastic enough to act as a compression spring.

It may be added at least to one end of said support part a stop 4 to prevent the movable arms 2 from slipping away out of said support part 1 when they are not held back on said part by some clamping action and said support is kept more or less upright.

As it has been said before, a device according to the invention has been called an "assembler".

To be elastic enough to act as a compression spring said buffer 3 must be made of an elastic substance, supple like natural or synthetic rubber, foam plastic or even cotton, and that its thickness under the contact face must be larger than one millimeter. It can be full or spongy structured. It can also be made of a hollow flat box with thin wood, hard plastic of metal walls which have the property of straightening up themselves when the pressure exerted upon them is reduced. Said contact face is more or less flat or slightly bowl-shaped and its seat is essentially at a right angle to said support part. For some applications however, said contact face can be convex. Said buffer can have also the shape of a slice sticked or an obturator fixed by a spike on said movable arm or the form of a ring slipped onto same arm at a distance from said support part. The advantage of a ring as a buffer as compared to a slice or an obturator is its capacity to be fixed on said arm without needing sticking on or boring an opening through said arm. Its internal dimensions must only be smaller than or at the most equal to said arm external dimensions at the place where it has to be secured, so that it can be forcibly slipped on the arm to said place and stay locked thereon.

According to another arrangement, the buffer is made up of a pile of substantially elastic slices in the way of a Belleville washer spring; in a first subarrangement, slices are sticked one on top of the other; in a second subarrangement, slices are pierced and slipped on top of the other too by a gentle forcing onto a second cylindrical part which is parallel to said support part. Said second cylindrical part is slidingly positioned behind said buffer contact face through the arm which carries said buffer

and is held back by a stop similar to the ones which might end said support part.

One of said means to permit one of said movable arms 2 of sliding along said support part 1 is constitued by a passage hole, of which the inner shape surrounds very closely the outline of said support part 1. But such a means may also consist of a stirrup secured to said arm 2 side, said stirrup forming a loop; another possibility is to shape said passage hole by building each of said arms 2 with two half-arms each provided within its thickness with a cylindrical semicircular groove, the groove hollow of each half-arm facing the groove hollow of the other half-arm; a similar possibility is to put in one side of a whole arm, within its thickness, a cylindrical groove and to close this one longitudinally by a plate; it can also be considered of wrapping a tenon piece of said arms by a hollow rail constituting said support part.

Referring to FIG. 1 to 8, each stop 4 is composed by a section of cylindrical supple tubular sheath the diameter of which being slightly smaller than the average diameter of said support part. Said section is slipped on at end of said part by a gentle forcing. Such stops can also consist of clips, riders, pins or keys. But as compared with these last means, using some supple sheath to slip by force on said support part is an especially economical means, since no machining of said cylindrical support part and no special tools for manufacturing said stops are required even if said support part section is out of standards. Such a sheath can be found easily, because there is generally no special requirement, such as resistance to temperature rise or to hostile environment. Only said sheath section must be a little smaller than said support part average diameter and said supple sheath must keep its elasticity in the course of time with normal environmental conditions. Can be suitable for said sheath: supple tubes of PVC, medium or low density polyethylene, silicone, natural or synthetic rubber.

FIG. 1 shows an assembler according to the invention including only two movable arms 2. A single elastic buffer 3 is involved. It consists of a slice adhering to its carrying movable arm 2 by sticking or by a spike which has been made penetrated by force into a hole bored in said arm 2.

As for FIG. 2, it shows an assembler according to the invention including only two movable arms 2 where two elastic buffers 3 are employed, one per arm. Each of these buffers consists of a slice adhering to its carrying arm 2 by sticking or by a spike which has been made penetrated by force into a hole bored in said arm 2.

As for FIG. 3, it also shows an assembler according to the invention including only two movable arms 2 where two elastic buffers 3 are employed, one per arm. But each of these buffers consists of a ring of rubber or other material or an equivalent plastic alveolate structure slipped by forcing onto its carrying arm 2.

In view of FIG. 4, to operate a clamping with an assembler according to the invention and including only two movable arms, it is enough of:

- bringing the set of the objects 8-9 to be clamped between the arms 2, opposite the contact faces of the substantially elastic buffers 3;
- pushing with fingers or the hand palm upon the backs of the arms 2, on the reverse side of said contact faces, in direction of said objects 8-9.;

arms 2 then slide along said support part; as soon as said contact faces are touching said objects 8-9 by the surfaces to be held, the fingers are feeling a resistance as if they were directly pushing on said objects: it is by translation more or less the resistance exerted by the objects 8-9.
- going on to push upon backs of arms 2 while increasing pressure so as to compress the buffers;
- As soon as the hand is feeling that has been reached the force sufficient to suitably clamp said objects against each other, stopping to pusch; movable arms 2 are locking on then automatically and instantly by tipping against said support part as the suspended poles of the ski tow do against their cable.

It is worth noting that an assembler according to the invention performs as a relay of the human fingers or hands (in the sense of replacing) for the accomplishment of a task like clamping. It can actually keep a clamping position as long as it is needed under the same effort the hand(s) can temporarily hold.

A single pushing upon the reverse of said arms 2 with respect to said objects 8-9 at a distance beyond said support part 1 from said buffers is enough to unlock said arms 2 and to release from clamping the set of objects.

The holding apart operation with an assembler according to the invention including only two movable arms is performed in a similar way. However, the arms must be first reversed along said support part so as to turn the contact faces of said buffers towards the outside. These contact faces are brought into contact of the objects to be held apart. The operation is then carried further on in a way similar to the clamping operation as soon as the fingers or the hand palm begin to push upon the back of said arms, except that the force to be manually felt is the one with which it is wanted to hold apart.

FIG. 5 shows a variant of the assembler including only four movable arms, each of said arms having an elastic ring buffer 3 secured thereto at a distance from said support part 1, the buffers of the first two arms 2a and 2b along said support part 1 having their contact faces facing the contact faces of the buffers of the two following arms 2c and 2d. The first two arms 2a and 2b are pointing in two directions V-diverging about said support part and are facing the two following arms 2c and 2d, more or less arranged according to same V. Roughly the buffer 3 of first arm 2a is facing the buffer of third arm 2d while the buffer of second arm 2b is facing the buffer of the fourth arm 2c. As it has been told above, such a configuration has been given the name of "overlapper" or "super-assembler" and the clamping operation which consists in moving closer the two V from each other, the name of overlapping. It is enough to manually push upon the backs of the movable arms along said support part 1 towards the objects to be clamped. As soon as the buffer contact faces are touching the surfaces of said objects and as a sufficient resistance is manually felt, it is enough to stop pushing. The movable arms 2 are then locking clamped onto said objects still by tipping against said support part. The overlapping can be used as well for holding apart. The operation is the same except that arms are reversed along the support part. A configuration halfway between a single assembler and an overlapper or super-assembler according

to the present invention consists in using two movable arms V-diverging in front of a single third one for the clamping. Depending on the relief of the surfaces to be held, such a configuration might be sufficient.

As for FIG. 6, a third pair of movable arms 2e-2f, called a "holder" is slipped on the bare portion of the support part 1 of an overlapper comprising two pairs of movable arms 2a-2b and 2c-2d grasping the edge of an horizontal bench or equivalent. Each of said third pair arms has also secured thereto an elastic ring buffer. Such an holder in clamping or holding apart position can keep in position some objects to be painted or to be worked on with free hands. Such a configuration has already been given the name of third vertical helping hand.

FIG. 7 shows another configuration of helping hand: a fourth horizontal helping hand. It includes four pairs of movable arms 2a-2b, 2c-2d, 2e-2f, 2g-2h, placed one behind the other along said support part. Each of said arms has secured thereto one elastic ring buffer 3, said buffers facing each other by their contact face for each pair. At one end of the support part, the two first pairs of movable arms 2a-2b and 2c-2d are separately locked by clamping with each buffer having its contact face against the contact face of the other buffer at an angle close to 70°. Along the remaining portion of the support part, the third pair of movable arms 2e-2f and the fourth couple of movable arms 2g-2h are constituting "holders" for keeping objects in position to be painted or to be worked on with free hands. Of course the buffers of the two first pairs of movable arms 2a-2b and 2c-2d locked at one end of the support part are making up with the other end of said support part a tripod. Each holder can be used as an assembler comprising two movable arms for clamping or holding apart operations.

Nota bene: So that one of the above-mentioned helping hands could keep objects in position firmer, one holder can be replaced by one overlapper.

FIG. 8 is showing a "radial clamping". On the support part 1 of an assembler according to the invention is secured as a coupler a pliable little bar 5 of electrical connecting devices which has been bent. Said support part 1 is carrying two movable arms 2a-2b, each of them having secured thereto one elastic ring buffer 3. Said bar 5 is bent because it is secured on said support part 1 by two contacts 6 and 6a which are normally far from each other and which have been brought closer by torsion of the little bar within its medium plane. The screws of said contact screws are turned tight against support part 1, i.e. they are jammed against it. The contact 7 of the little bar is used to secure, still by screwing thereagainst, another cylindrical support part 1a which carries two other movable arms 2c-2d, each of them having secured thereto one elastic ring buffer 3. The first support part 1 is more or less at a right angle to the other support part 1a. The clamping operation for each pair of movable arms 2a-2b and 2c-2d is identical to the operation for an assembler according to the invention comprising two movable arms. In this way, as illustrated in FIG. 8, it is possible to clamp things by four sides between the movable arms which are carried by these two support parts. Such a clamping has been given the name of cross clamping. It would be also possible with some additional cylindrical support parts held by other contacts of the little bar and carrying each at least one movable arm of clamping things by a vast

number of sides, which is a radial clamping. In the same way, to said second support part 1a can be secured another coupler holding a third support part 1b in a direction distinct from the directions of the first two support parts, and possibly one more coupler can be secured on this third support part, and so forth to build a chained radial mounting. Such a chain configuration might be helpful to clamp the objects with complicated outlines. Another model of coupler can consist in a crosspiece including two or more pipes which are diverging and which can keep captive by a screw system or the like a support part like a rod or a tube. This kind of crosspiece is used for instance in electricity as a shunt contact. Crosspieces are also employed in the Navy or in "Mecano" building set to secure the crossing of two cables or halyards.

In another arrangement of the assembler according to the invention including only two movable arms 2, the support part 1 is splitted up into several cylindrical parallel components, which are constituting in fact so many parallel and homogeneous support parts. Said components are made interdependent at each of their ends by couplers which might look like little bars of electrical connecting devices when said components have almost the same diameter. Each of said arms might be running along all these components. Each arm has a wide pressing face. In a first kind of subarrangement, the elastic buffer 3 secured to one or each of both arms is formed of one piece. In a second kind of subarrangement, the substantially elastic buffer 3 carried by one or each of both arms is splitted up into several pieces; in this case, said pieces are located at a single distance from the median plane which contains the different cylindrical components of said support part; said pieces might be left working independently from each other or sandwiched between the arm which is carrying them and a rigid linking plate meant for acting as a jaw towards objects to be clamped. The sandwich configuration with several elastic buffer pieces put between the arm which is carrying them and a rigid plate turns out to provide a firmer clamping than the single buffer configuration for the same compression force. Of course, this implies a synergetic effect. In the second kind of subarrangement, when the buffer is splitted up into several pieces, the arm might be itself splitted up into several blocks each carried by one or several components of the support part. As said components are constituting so many parallel support parts, it is as if several assemblers according to the invention were coupled together in parallel to make up a multipoint vice.

It is worth noting moreover that the device according to the invention might find many applications such as securing an apparatus to a support when said apparatus is made interdependent of or is constituting one of said arms.

It stands to reason that this invention was only described and illustrated on a purely explanatory and not in the least restrictive basis and that it will possible to make any variant of it without getting off its scope.

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